EEPROM с двойным интерфейсом RF/serial

ноябрь 2011

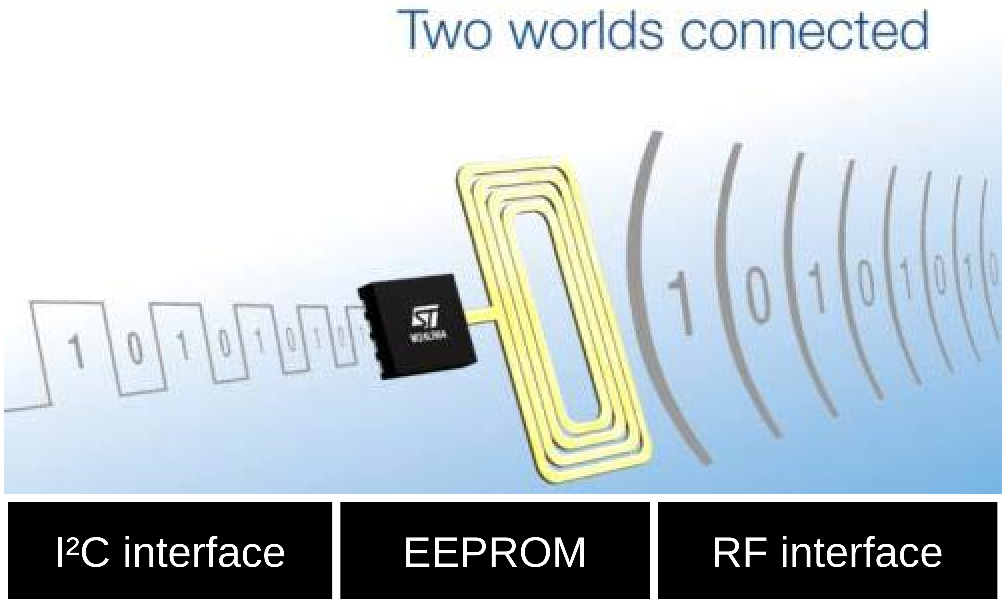
The Dual interface E2PROM in

HOME APPLIANCES

Dual Interface EEPROM – Introduction

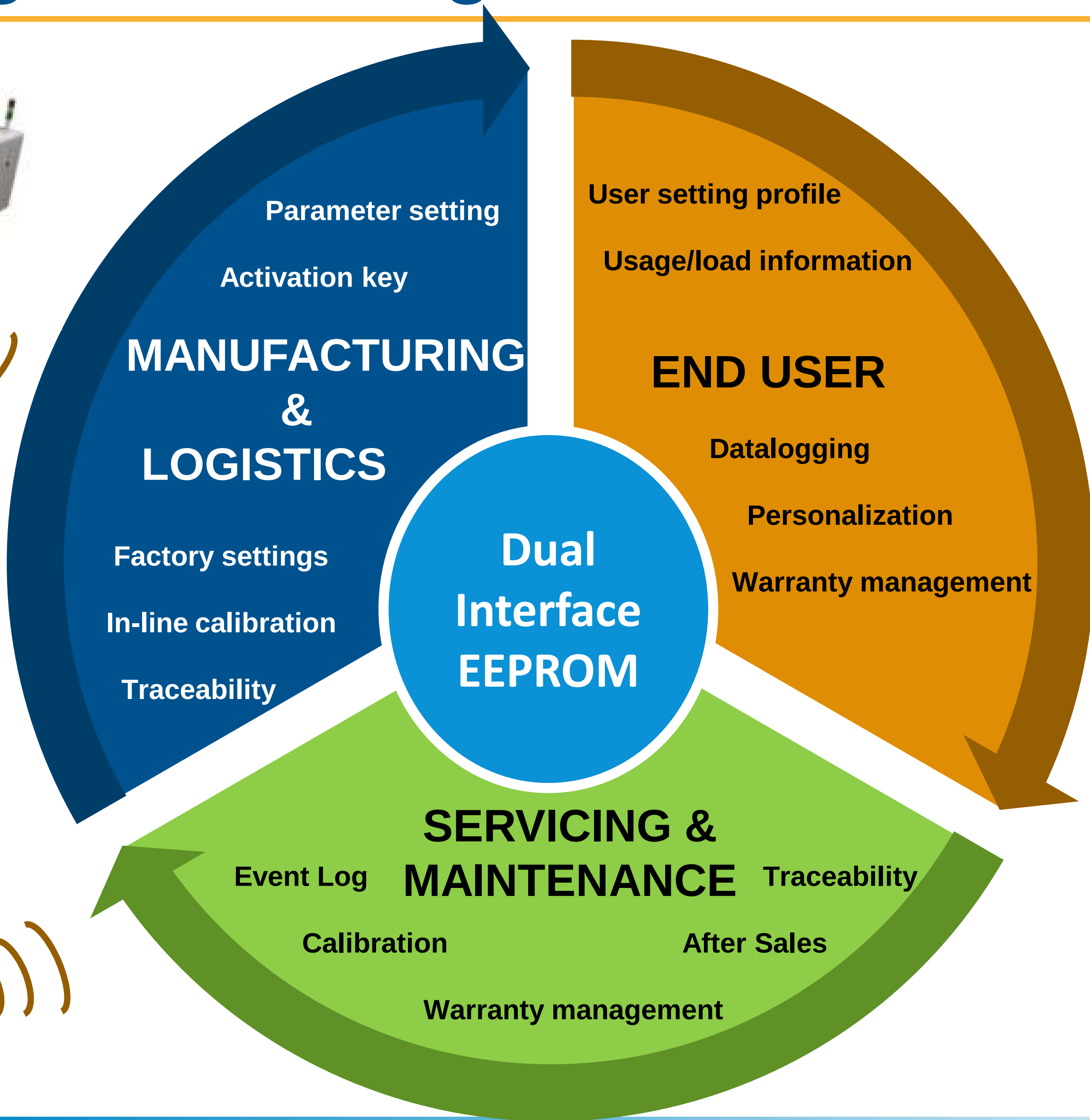
The Dual Interface EEPROM is an electrically-erasable memory which communicates with Read and Write attributes through :

- **a wired I²C interface with MCU or chipset**
- **RF, using an industry-standard ISO 15693 which does not require any on-board power**



Enabling a wide range of use cases…







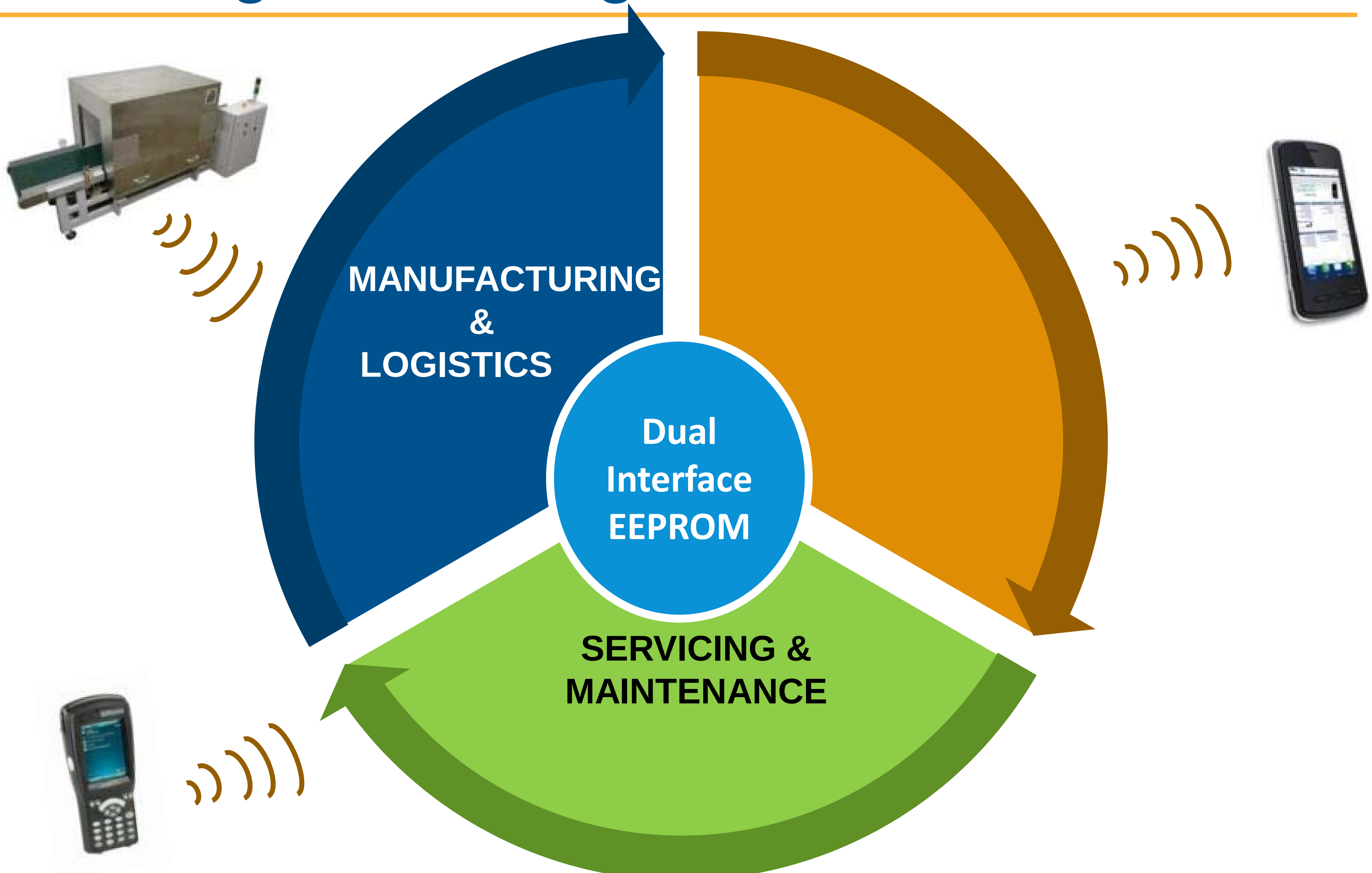


Concept

→ Simplified Appliance design and improved customer experience at the same time
→ Faster diagnostic and better customer service
→ Direct connection to the end-customer



Enabling a wide range of use cases…



Improved customer service



Traceability information

- Serial #
- Model ID
- Firmware version
- BOM version
- Date code
- Warranty information

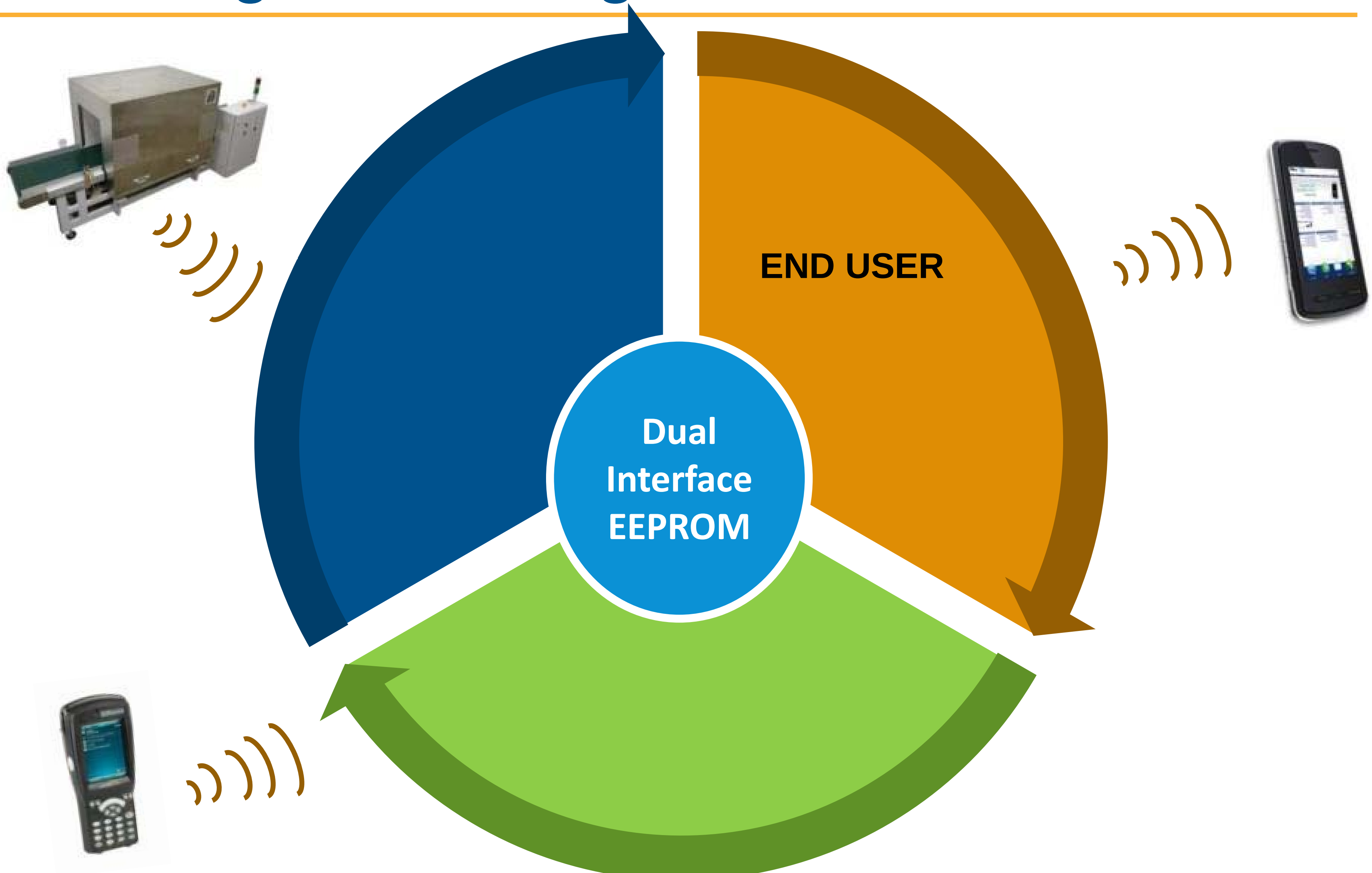
Product settings & history

- Calibration
- Factory settings
- Event recorder
- Temperature log



Works even when the Appliance is powered off !

Enabling a wide range of use cases…



Simplified and cost-effective design



- **Minimize on-board data processing**
  - **Just store raw and compacted data in the Appliance's Dual Interface EEPROM**

- **Reduce Appliance's user interface cost**
  - **Limited or no display**
  - **Reduced number of function buttons**

Improved experience







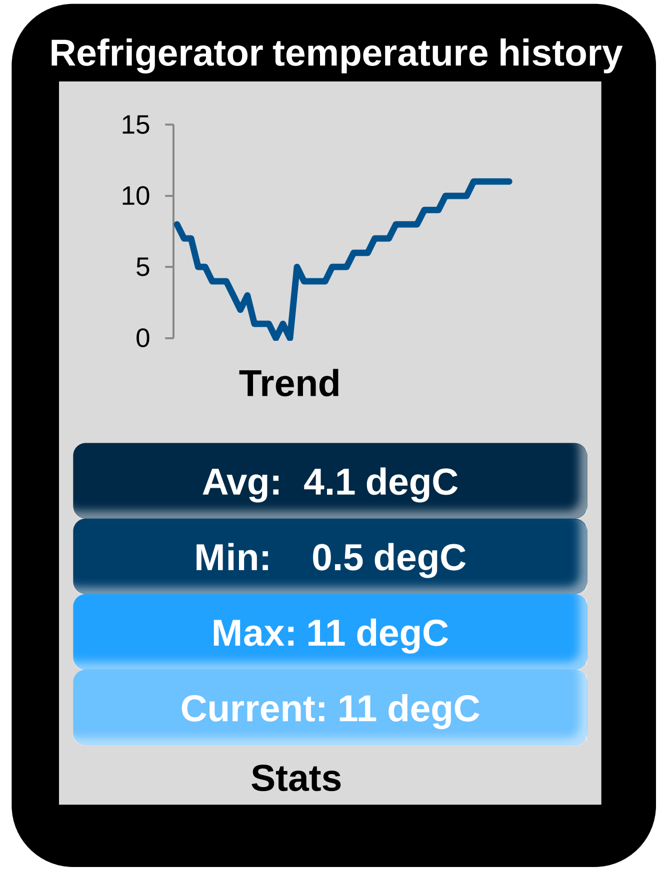
- User Manual's URL
- Usage / load information
- Power consumption history
- Warranty information
- Date of purchase
- User profile setting and reading
- Model ID
- Event recorder/temperature log
- Calibration data

Use smartphone for data processing and user-friendly interface

Improved experience







Enabling new perspectives - Fridge



- **Water filter management**
  - Interrogate remaining lifetime before shopping and order it on your smartphone
- **Interrogate temperature history**
  - Useful after unexpected power outage
  - Also load/usage information
- **Turn on low power or boost modes**
  - Activate low power mode before leaving for a long period
  - Turn back to full load when back
- **Cooking recipe management**
  - Download cooking recipe on smartphone
  - Interrogate fridge to verify if all ingredients present

Enabling new perspectives – Oven



- Cooking recipe management
  - Download cooking recipe on smartphone
  - Program the oven according to the recipe baking profile
- Download and program latest baking profiles from manufacturer

Enabling new perspectives
Coffee makers





- Reuse saved user profile including quantity of coffee, which beans to use, quantity of water,..
- Deported display on a smart phone offering higher functionality.
- Get statistics on most often used coffee and order beans or capsules directly thru the web/thru an app.

Enabling new perspectives - docking



- Original equipment recognition (as with RFIDs today)
- Battery type recognition for universal chargers
- Communicate battery status (current, voltage temperature,..) to the charger
- Communicate usage data (intensive usage or not?)



Technical Support Request

Support request:

support@promelec.ru

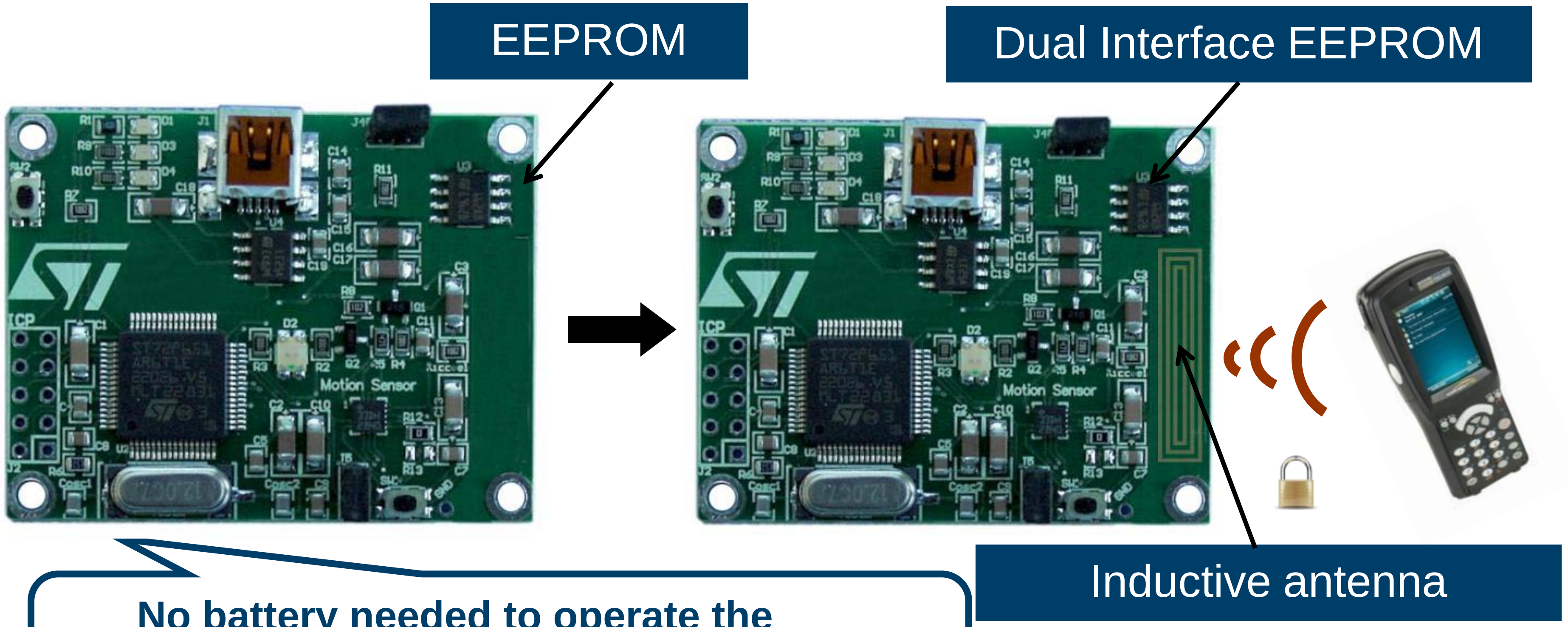


Focus on

DUAL INTERFACE E2PROM

Dual Interface EEPROM - How it works

- **Based on Passive RFID technology**
- **> Just add a 13.56 MHz inductive antenna onto your PCB**

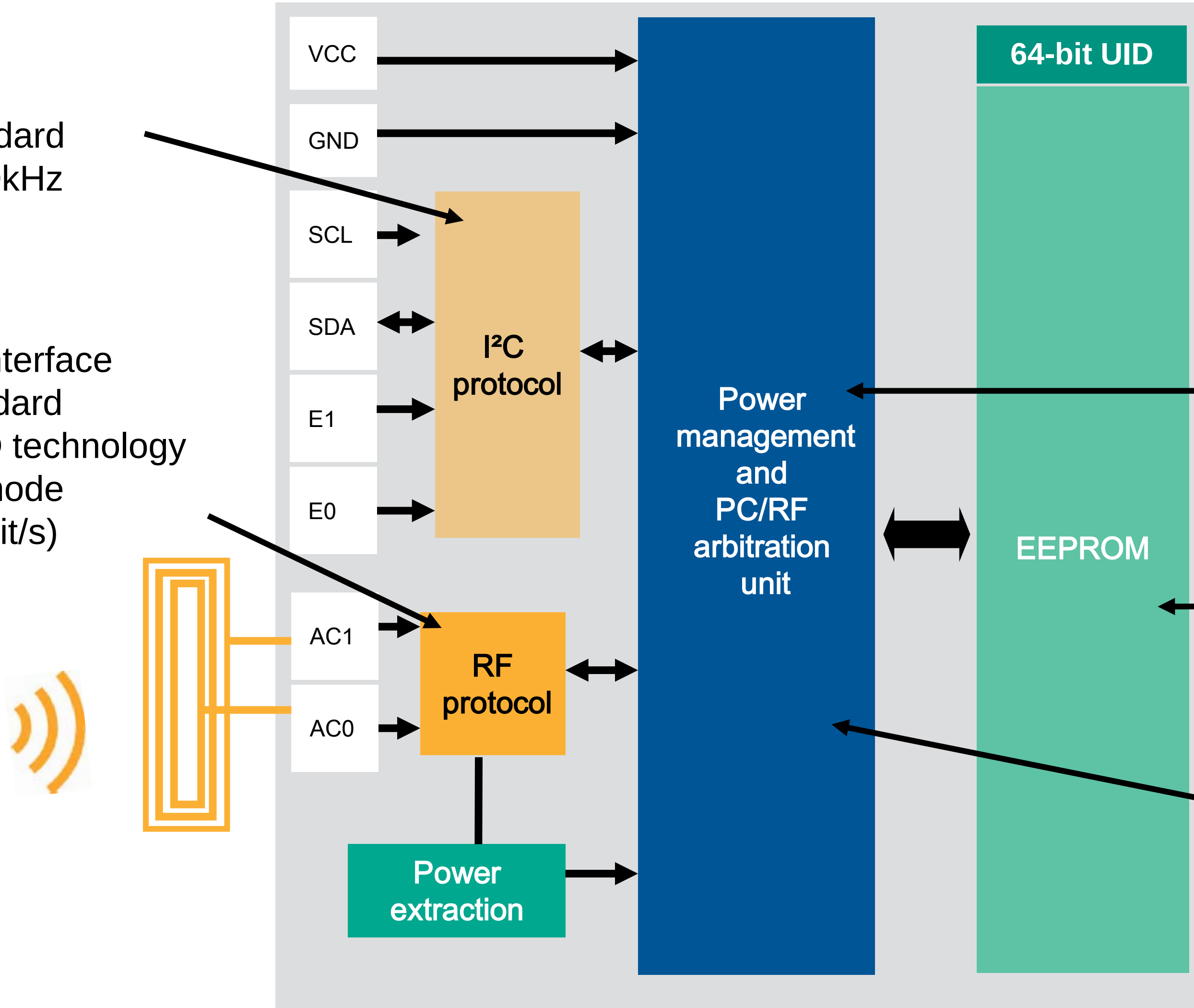


No battery needed to operate the Dual Interface EEPROM in RF mode

M24LR64 block diagram

I²C interface
- industry standard
- 1.8-5.5V, 400kHz

ISO 15693 RF interface
- industry standard
- passive RFID technology
- high-speed mode (up to 53 Kbit/s)



64-bit Unique Identifier (Factory-Programmed and Locked)

I²C/RF arbitration

64-Kbit EEPROM

Password protection scheme

13.56MHz ISO15693 radio

13.56MHz ISM frequency band
(Industrial, Scientific, Medical)

No interference with
cell phones, bluetooth, wifi, zigbee, …

Zero power radio (*)
(low data rate and « short » range)

ISO15693 established
industry standard

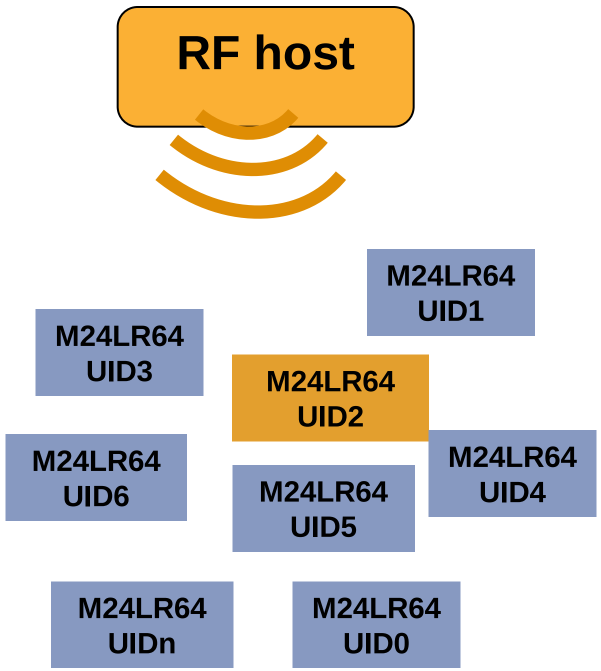
(*) **Energy provided by the RF host**

RF host capable of identifying and communicating
with several M24LR64 in parallel

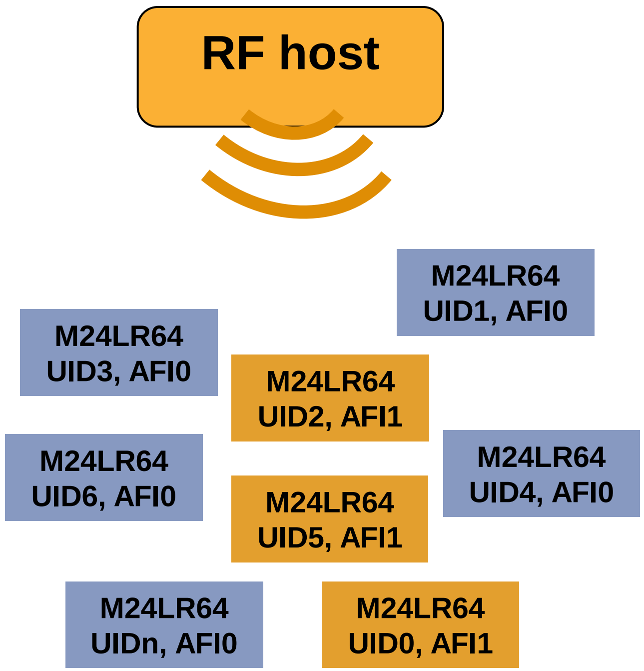
Multi-device capable radio

- ISO15693 protocol enables to communicate with:

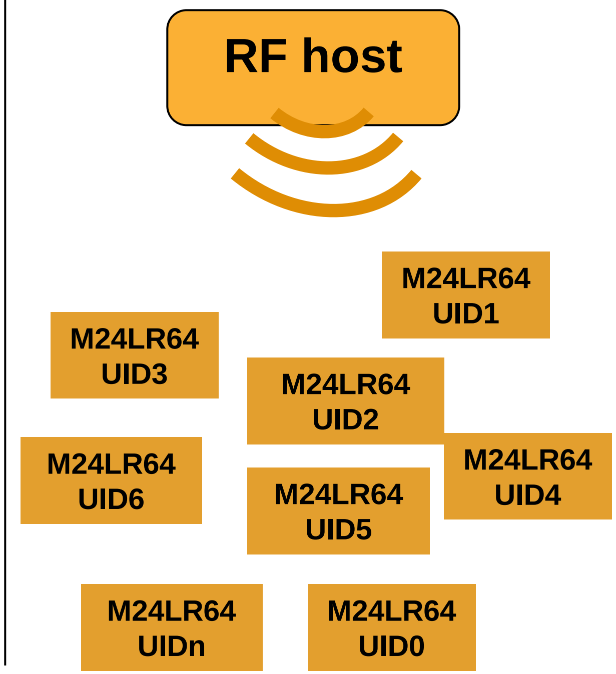
- >One device
- among many
- (select UID)



- >Several devices
- among many
- (select AFI)



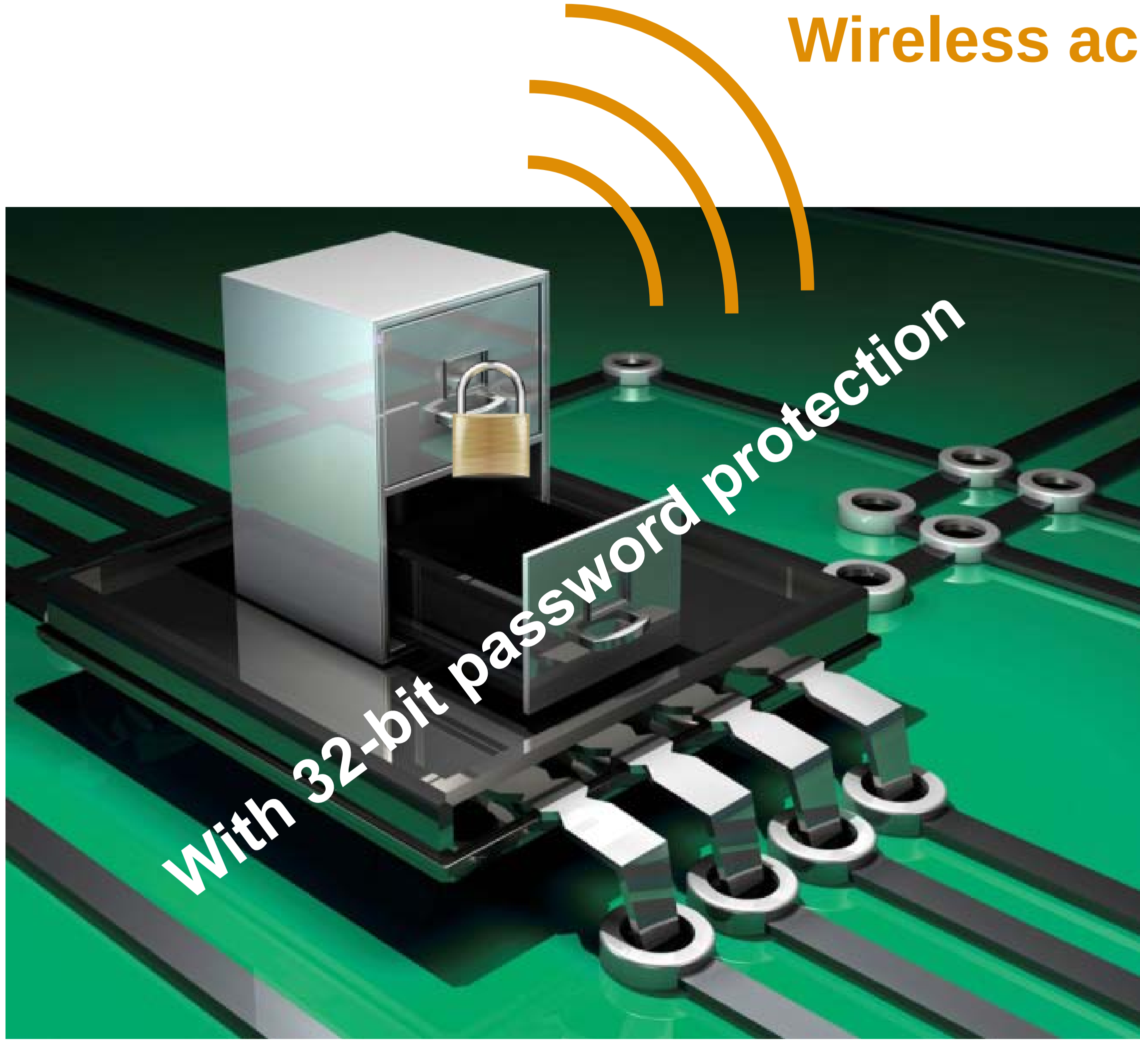
> All devices
among many
(all UIDs)



Dual Interface EEPROM…
REAL new perspectives for data management !

Wireless access

- Operating data
- User settings
- Traceability information
- Application data
- Event log
- Identification data



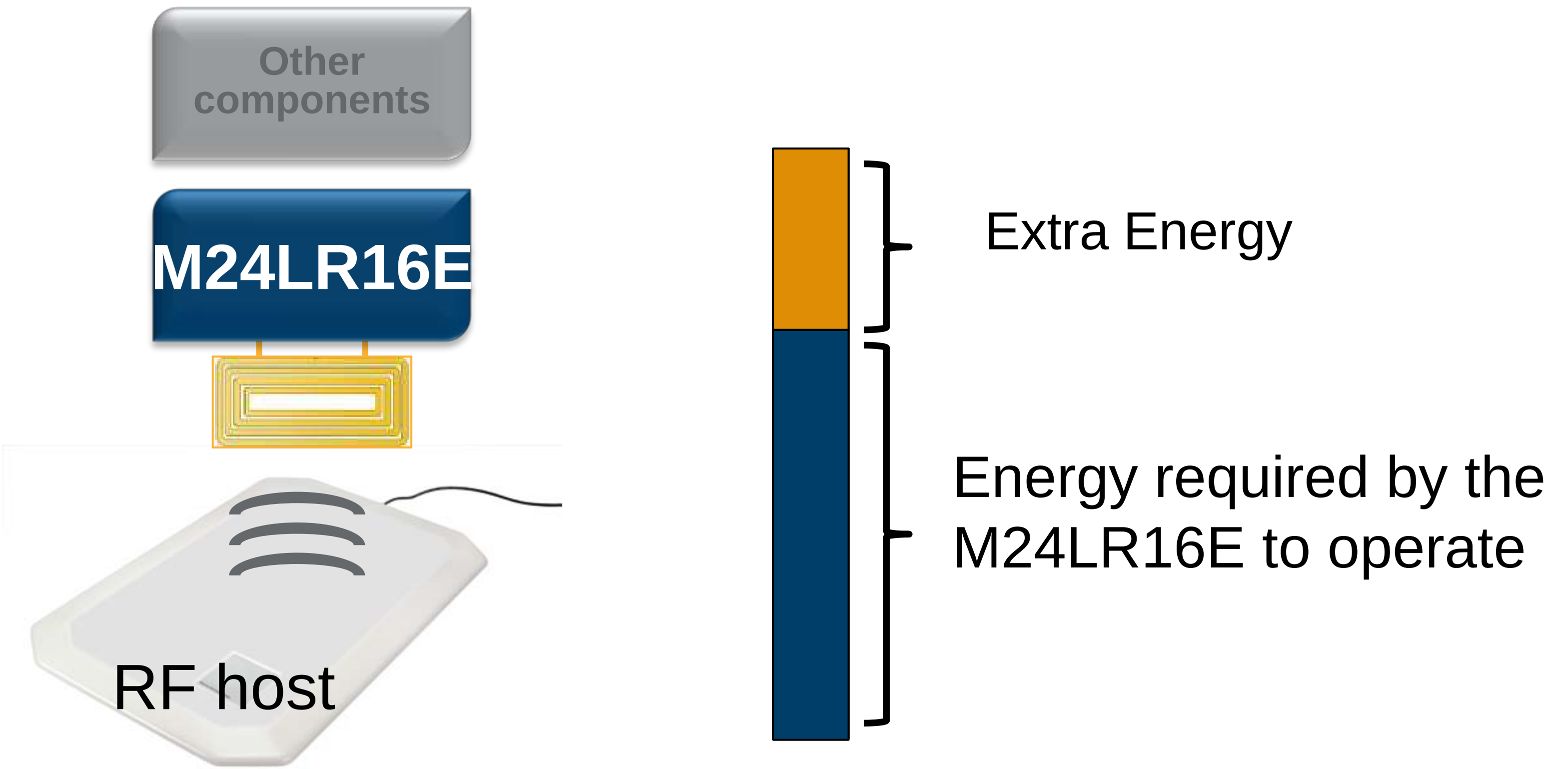
M24LR64 is also a low power I^2C EEPROM

	M24C64 (serial)	M24LR64 (dual)
Icc operating write @2.5V	**5 mA**	**0.4 mA**
Icc operating read @2.5V	**2 mA**	**0.2 mA**

Great for event recorder !

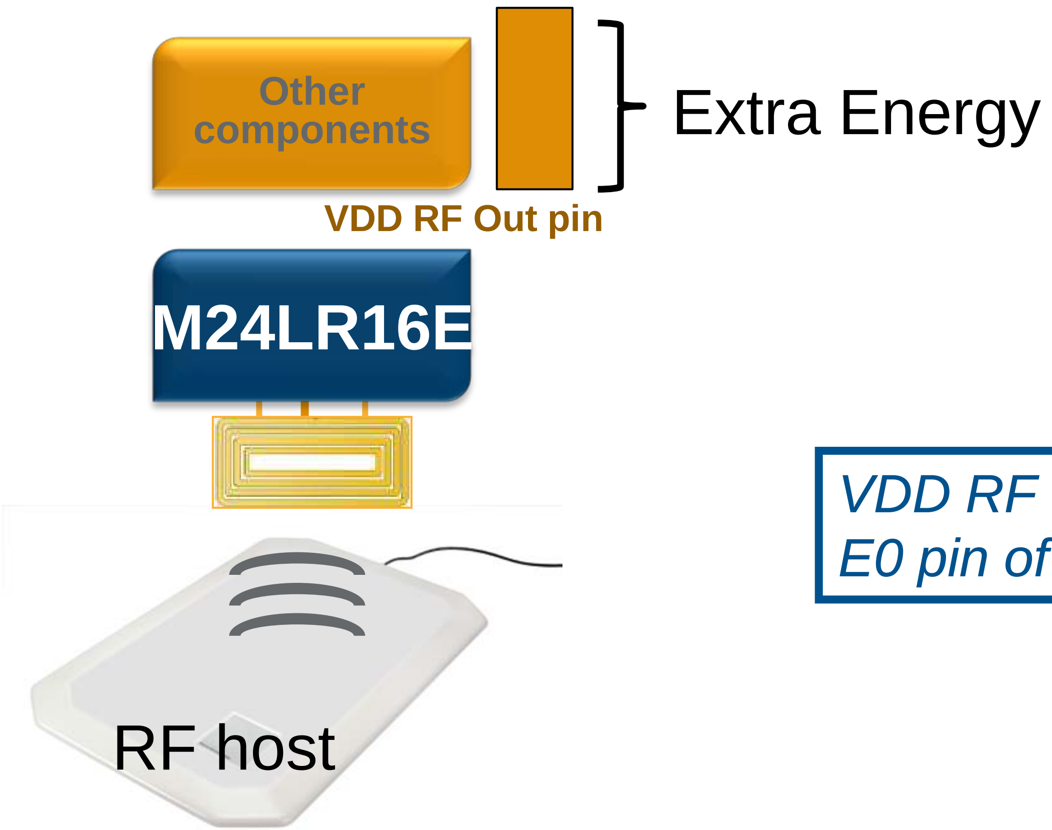
What is M24LR16E Energy Harvesting? - 1

- When the M24LR16E captures [from the RF host] more energy than needed to operate,
- some extra energy is available



What is M24LR16E Energy Harvesting? - 2

- When the Energy Harvesting (EH) function is ON,
- the M24LR16E can deliver the extra energy to other components



VDD RF Out pin to replace E0 pin of existing M24LR64

M24LR16E block diagram

NEW

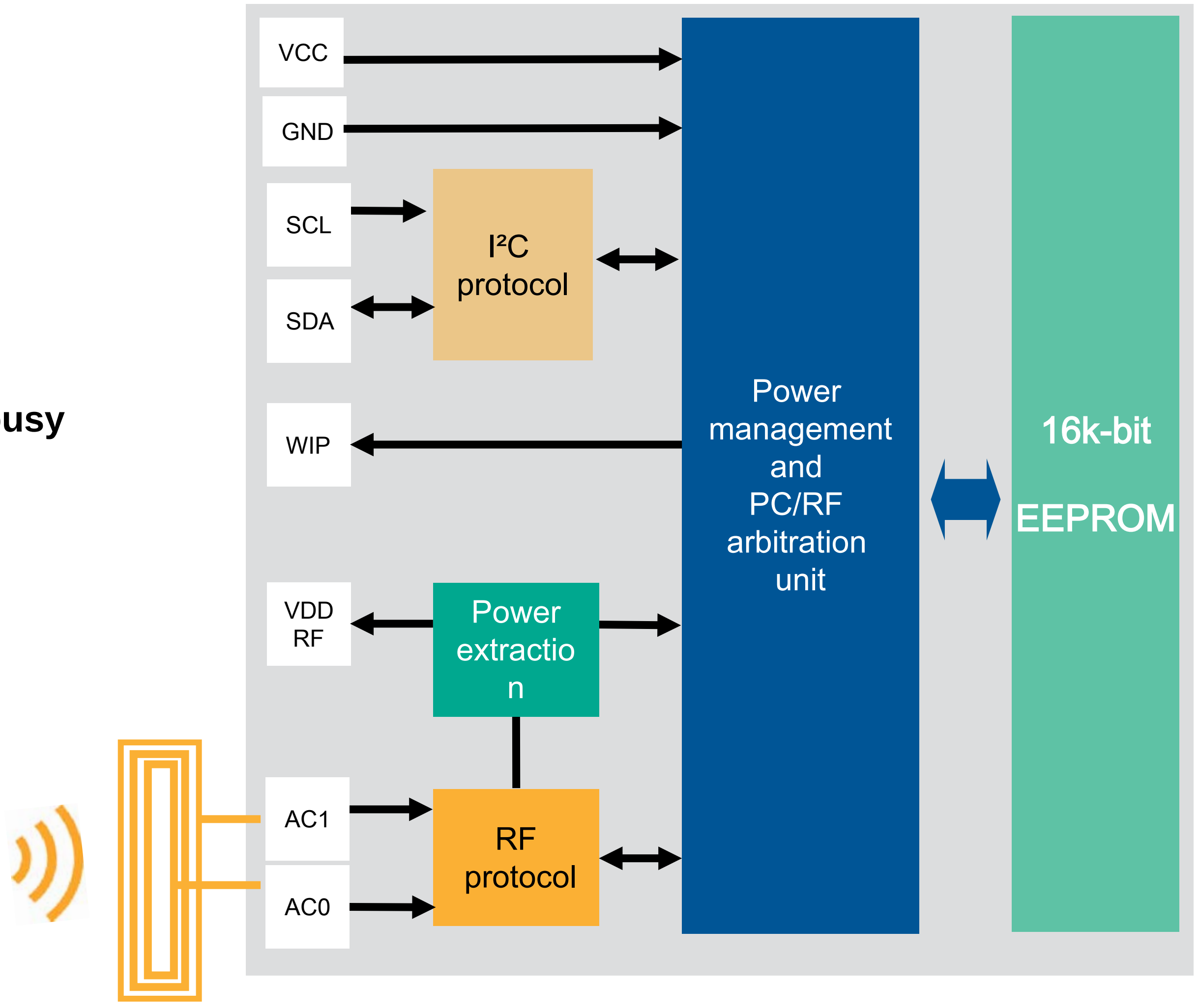
External power supply

I²C interface

RF Write In Progress or RF busy (Digital output)

VDD RF Out (energy harvesting from RF)

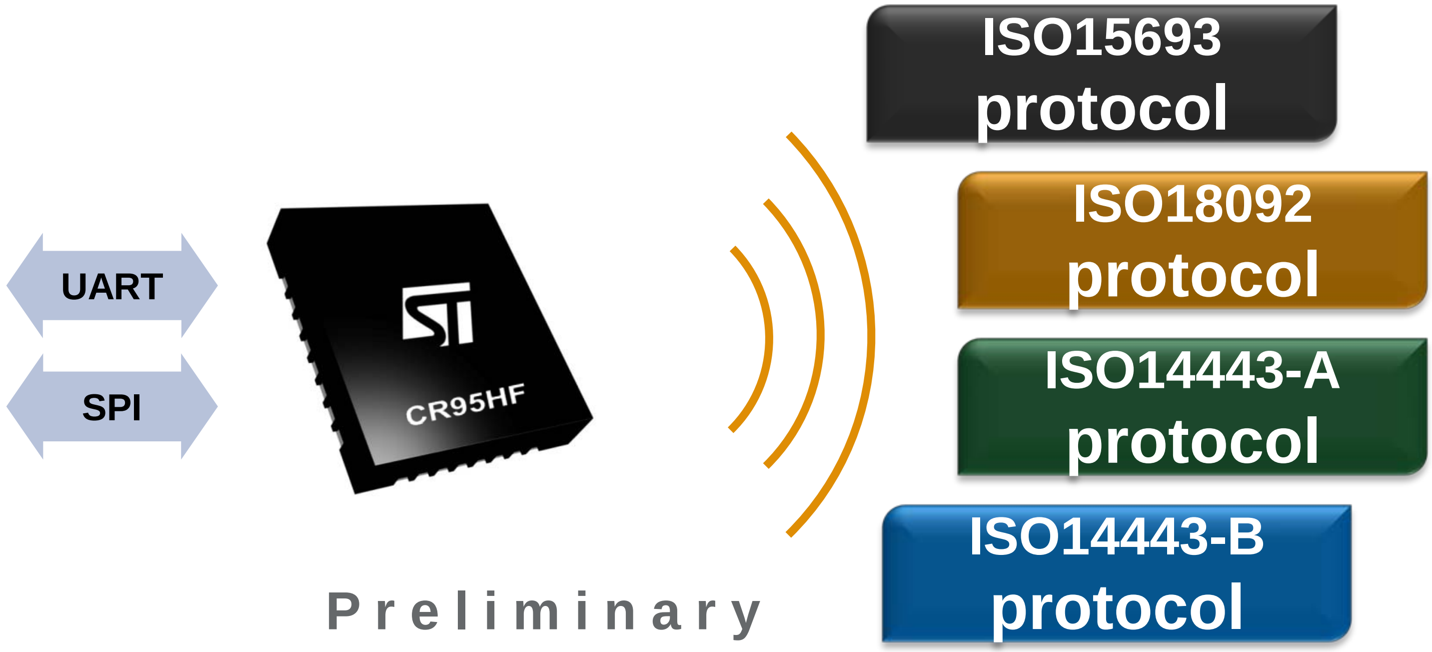
ISO 15693 RF interface



CR95HF overview

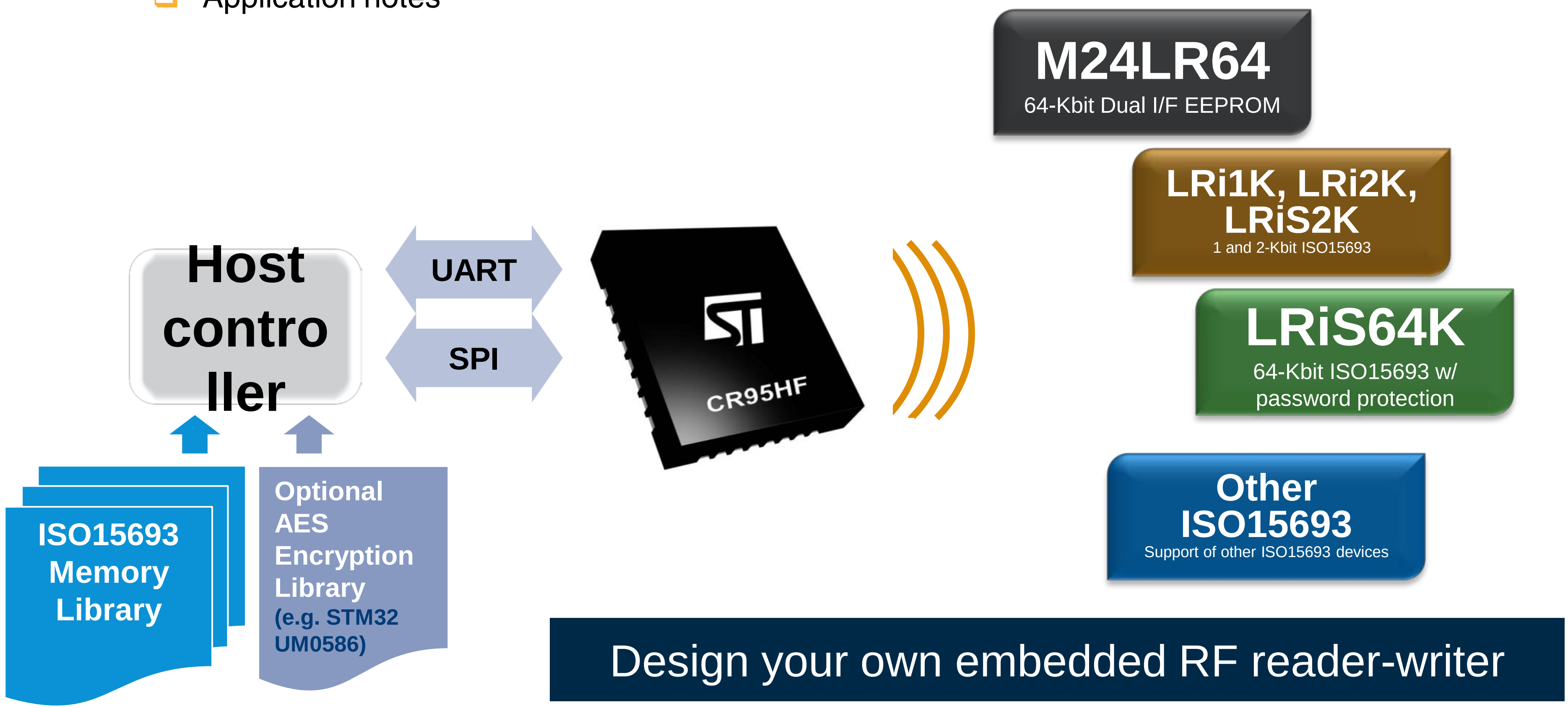
SOONER

- Multi-protocol 13.56MHz Contactless Transceiver IC
- ISO15693, ISO14443 A-B and NFC ISO18092 compliant analog front-end
- UART and SPI interface
- No Card emulation nor peer-to-peer mode
- Standard QFN32 package, 5x5mm
- 3V operation



Embedded reader-writer: CR95HF chip

- ST ISO15693 products will be supported by the CR95HF with
  - Software libraries
  - Reference design
  - Application notes

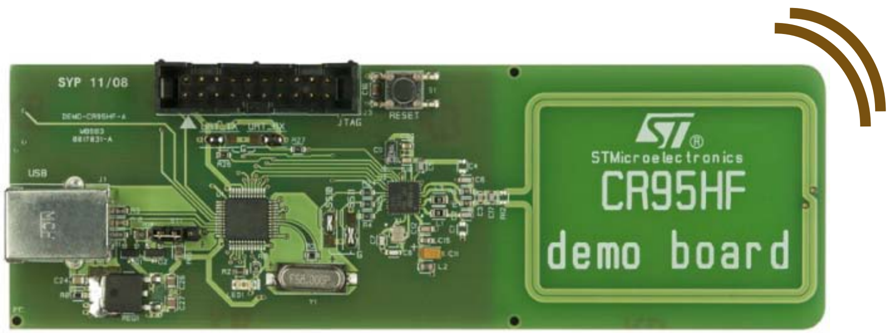


DEMO-CR95HF-A: package support

SOONER

CR95HF drivers (ANSI C)
- Source code CR95HF drivers v1.0.rar
- Application note AN3355

Schematics and gerber files
- Schematics (0017031-B-SCM.pdf)
- Gerber files (0017031-B-Gerber.zip)



PC demonstration software
- M24LRxx Application Software 2.2.zip

Antenna design guidelines
-Application note AN3394
-Antenna design simplified basic tool

Preliminary

Manufacturing & logistics benefits

Flexibility

- Remote parameter programming
- Last minute changes and updates

Customization

- Regional settings
- Display brightness
- Options activation
- Pre-personalization

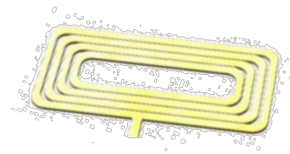
Control

- Use of activation keys
- e-Pedigree of every meter produced
- Better control of Supply chain flow

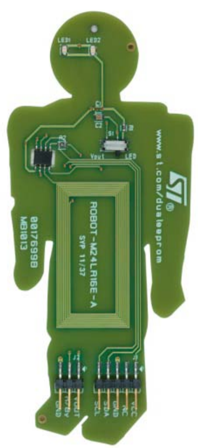
Better management of complex product configurations

Designers support - antenna integration

- ST provides documents helping customers design the antenna by themselves



  - Application note
    - AN2972 Designing an antenna for the M24LR64-R dual interface
    - AN3178 Using a surface-mount inductor as M24LR64-R antenna
  - Software
    - Executable meant for computing a 13.56 MHz antenna
  - Reference designs



ROBOT-M24LR16E-A



ANT1-M24LR16E



ANT2-M24LR16E



ANTx-M24LR-A

Dual Interface EEPROM & NFC Android Application

- Name: Dual EE
  - Source codes are sample code only, provided as an example.
  - The App has been developed and validated on the Google phone, i.e. the Samsung Nexus S phone, on Android OS 2.3.3.
- Tagged as: Dual EEPROM
- Developed and validated on the Google phone (Samsung Nexus S) with Android v2.3.3

- App location: Android Market
- Source code locations: https://market.android.com/

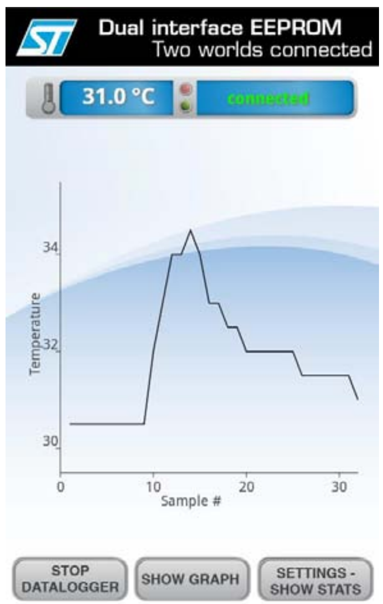
- Icon



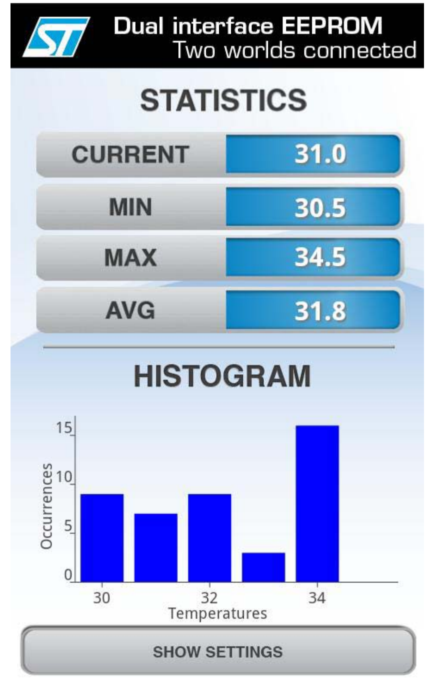
Datalogger App with NFC Android



Dual Interface EEPROM detection

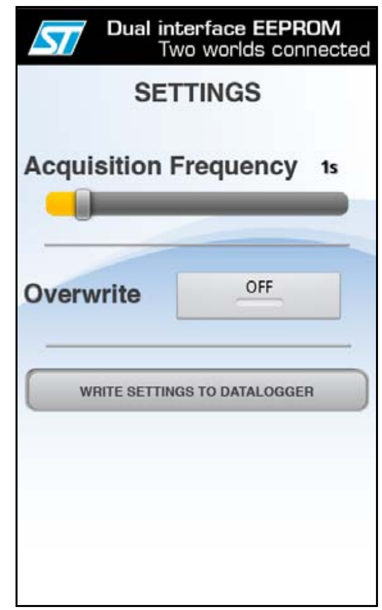


Latest temperature recorded in the datalogger



All temperature records stored in the datalogger

Settings and Statistics button



4 types of RF reader-writers

- Commercial ISO15693 RFID reader-writers, available through partners



- ST's 13.56MHz transceiver IC for embedded RF reader-writer



- Coming soon… mobile phones with
  ISO15693 capable NFC function



- ST's evaluation kits for evaluation / development



Commercial RF reader-writers.

- **ISO15693 standard at 13.56 MHz - Firmware upgrade might be required**
- **Exists in various form factors providing wide range of price and performance**



Handheld reader



RFID reader



Pad/desktop antenna



Tunnel station



Paddle reader



Conveyor tunnel reader



Gate antenna



CF module

Video at www/st/com/edemoroom - (Play « Dual Interface EEPROM RF technology »)

Commercial RF reader-writer partners

- **ST is developing a network of reader partners, which are supporting the M24LR64.**

- **More information av**[...]**at** www.st.com/dualeeprom